

# इंटरनेट

# मानक

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IS 6750 (1985): Cylinder liners for internal combustion engines [TED 2: Automotive Primemovers]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



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## Indian Standard

SPECIFICATION FOR CYLINDER LINERS  
FOR INTERNAL COMBUSTION ENGINES

( First Revision )

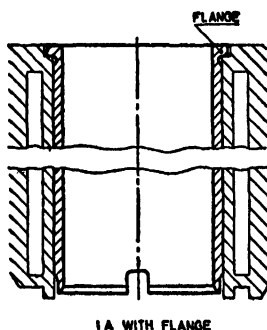
**1. Scope** — Specifies technical supply conditions for cast iron cylinder liners, dry and wet types applicable to reciprocating internal combustion engines working on 2-stroke or 4-stroke cycles.

**1.1** Wet cylinder liner supplied with outside surface as cast are also covered.

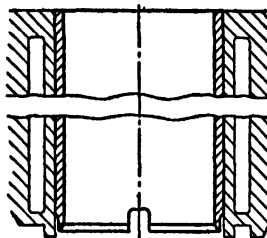
## 2. Definitions

**2.1 Dry Cylinder Liner** — A cylinder liner which does not experience any direct contact with the engine cooling media. This type of liner is in contact with the cylinder block material over its entire length or nearly its entire length.

**2.1.1** Dry liners may be of flanged type (see Fig. 1A) or without flange (see Fig. 1B).



1A WITH FLANGE



1B WITHOUT FLANGE

FIG. 1 DRY CYLINDER LINER

**2.2 Wet Cylinder Liner** — A cylinder liner which experiences direct contact with the engine cooling media. This type of liner is supported by the block only over narrow belts between which the

engine cooling media circulates. Wet cylinder liners can be of three different types depending on the system of sealing.

**2.2.1 X type wet liner**— A liner suspended from a flange at the top and in which the coolant passages are sealed at the bottom by sealing rings in grooves machined in the liner (see Fig. 2).

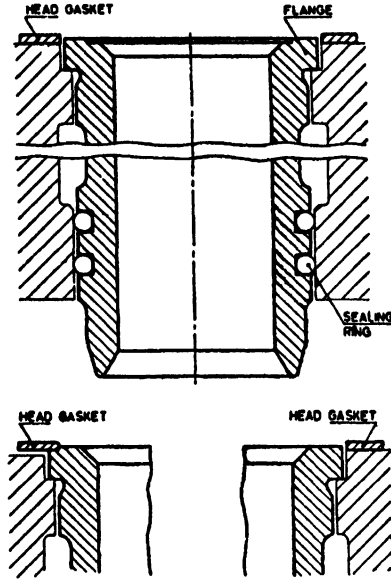


FIG. 2 X TYPE WET CYLINDER LINER

**2.2.2 Y type wet liner**— A liner suspended from a flange at the top and in which the coolant passages are sealed at the bottom by sealing rings in grooves machined in the cylinder block (see Fig. 3).

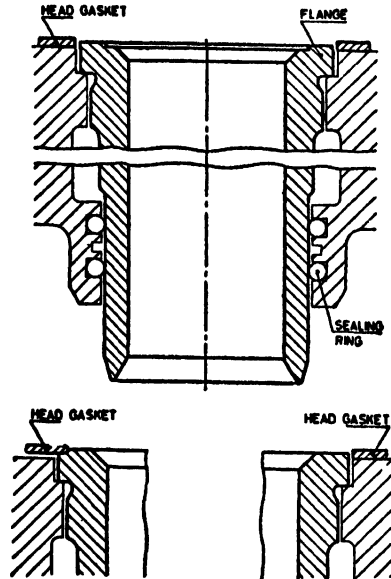


FIG. 3 Y TYPE WET CYLINDER LINER

**2.2.3 Z type wet liner** — A liner for which the coolant passages are sealed at the top flange by head gasket and bottom by flanges and gaskets ( see Fig. 4 ).

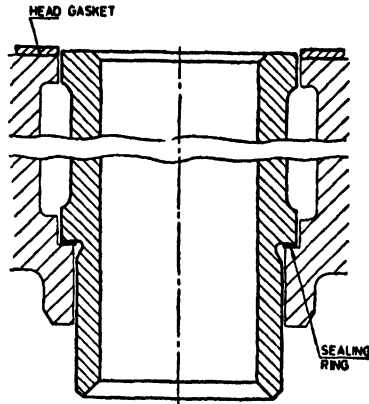


FIG. 4 Z TYPE WET CYLINDER LINER

**3. Material** — Cylinder liners shall be manufactured from good quality close-grained cast iron. The castings shall be produced either by centrifugal casting or by gravity die casting in metal or sand moulds or a combination of the two. The material of the cylinder liner shall satisfy 3.1 and 3.2 read with its subclauses.

### 3.1 Hardness

**3.1.1 Soft cylinder liners** — The Brinell hardness shall be measured on the machined upper end face of the liner in the cast condition, in the middle third of the cross-section thickness, according to IS : 1789-1961 'Method for Brinell hardness test for gray cast iron' and shall conform to the following:

Sand castings  
Metallic mould castings

180 to 240 HB  
According to Table 1 depending on  
wall thickness of the casting

TABLE 1 HARDNESS OF CYLINDER LINERS

Wall Thickness of the Liner Castings mm	Brinell Hardness HB
From 8 up to 25	210 to 290
Above 25 up to 50	200 to 280
Above 50	190 to 270

**3.1.2 Hardened cylinder liners** — Cylinder liners may also be hardened and tempered fully or partially as agreed to between the purchaser and the manufacturer. Recommended hardness for such liners is 45 to 50 HRC.

### 3.2 Micro-structure

**3.2.1 Graphite** — The graphite shall be fine to medium lamellar and shall be uniformly distributed. For centrifugal castings in metallic moulds, nest formations of graphite and inter-dendritic segregations randomly oriented are only permitted to the extent, that they are unavoidable and as agreed to between the purchaser and the manufacturer. Oriented and inter-dendritic graphite shall not be present in sand castings.

**3.2.2 Matrix** — The matrix shall have a pearlitic-sorbic structure without the presence of cementite. A maximum of 5 percent ferrite is permissible.

**3.2.3 Phosphide eutectic** — The phosphide eutectic shall be uniformly distributed and shall be large to fine net-work depending on the predetermined phosphide content as also the cooling conditions. (There shall be no closed formations).

**3.2.4 Stress-relieving** — Stress-relieving in the rough machined condition shall be as agreed to between the purchaser and the manufacturer.

#### 4. Dimensions and Tolerances

**4.1** The dimensions shall be as agreed to between the purchaser and the manufacturer. However, on enquiry and order, all dimensions indicated in the relevant Fig. 5 or 6 as applicable, shall be

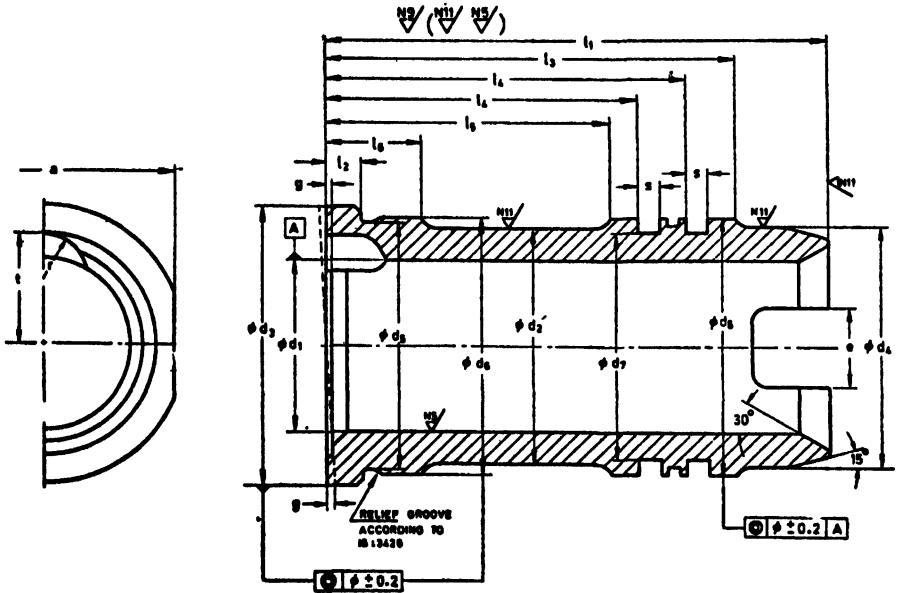


FIG. 5 DIMENSIONS FOR WET CYLINDER LINERS

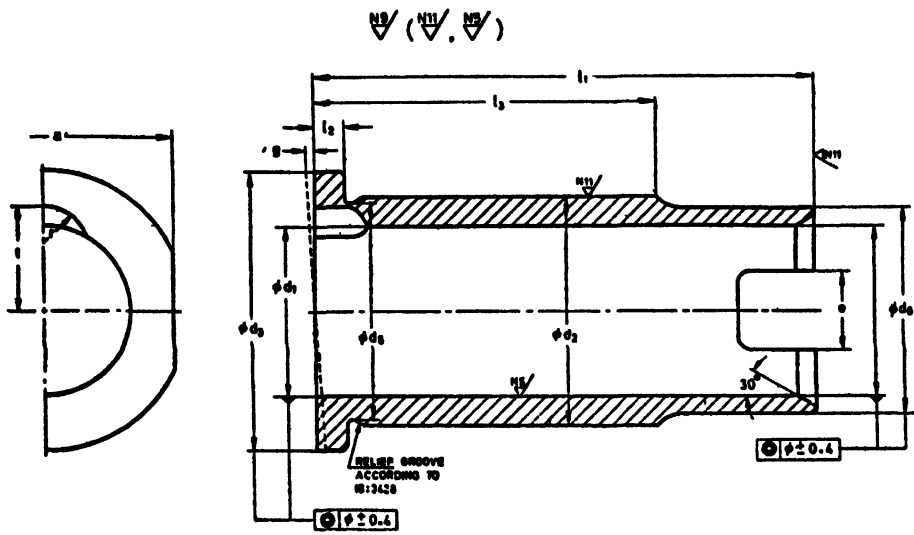


FIG. 6 DIMENSIONS FOR DRY CYLINDER LINERS

given. The tolerances of these dimensions shall be as specified in Table 2. The tolerances for cylinder liners of wet type supplied in the as cast condition for the position in contact with cooling media, shall be as agreed to between the manufacturer and the purchaser.

**4.2 Ovality and Taper** — The ovality and taper of the cylinder liner bores shall not exceed the tolerances of the cylinder bore diameters specified in Table 2. For this test, dry liners shall be inspected after placing them inside a suitable sleeve.

**4.2.1 Taper and ovality of outside locating diameters shall be within the diametral tolerance.**

**TABLE 2 TOLERANCES ON CYLINDER LINER DIMENSIONS**  
(Clauses 4.1, 4.2, 4.4 and 6.2 and Fig. 5 and 6)  
All dimensions in millimetres.

Dimension	Tolerance	Remarks
$e$	$-0.3$	Valid for all types of side milling
$d_1^*$	H7	For wet liners up to 150 bore diameter
	H8	For wet liners over 150 bore diameter
	H11	For dry liners ( pre-bored )
	H9	For dry liner ( finish honed ) up to 3.2 wall thickness
	H8	For dry liner ( finish honed ) over 3.2 wall thickness
$d_2, d_4$	$\pm 0.3$	Up to 150 bore diameter
	$\pm 0.5$	Over 150 up to 200 bore diameter
	$\pm 1.0$	Above 200 bore diameter
$d_3$	H9	—
$d_5$	$-0.5$	For wet liners
	$\pm 0.05$	For dry liners
$d_6$	$e_6 : r_6$	For dry liners ( outer mating diameter )
	17	For wet liners

\*Ovality of semi-finished dry cylinder liner outside diameters shall not exceed 0.15 mm and the average of major and minor diameter shall be within the diametral tolerance.

( Continued )



TABLE 2 TOLERANCES ON CYLINDER LINER DIMENSIONS — *Contd*

Dimension	Tolerance	Remarks
$d_1$	- 0.2	—
$e$	+ 1.0	—
$g$	$\pm 0.015$	Upper end face perpendicularity to the bore
$l_1$	$\pm 0.3$	Up to 400
	$\pm 1.0$	Over 400
$l_2$	- 0.04	For wet liners
	- 0.2	For dry liners
$l_3$	+ 1.0	For wet liners
	- 1.0	For dry liners
$l_4$	$\pm 0.4$	—
$l_5$	- 1.0	—
$l_6$	+ 1.0	—
$r$	+ 1.0	—
$s$	+ 0.2	Coarse tolerance according to IS : 2102-1969 *
$t$	+ 1.0	Coarse tolerance according to IS : 2102-1969 *

\*Allowable deviations for dimensions without specified tolerances ( *first revision* ).

4.3 Tolerances on chamfers may be of coarse class according to IS : 2102-1969.

**4.4 Eccentricity** — Eccentricity of liner bores with respect to outside diameters when measured as total indicator reading shall not exceed more than twice the tolerances of the cylinder bore diameters specified in Table 2.

#### 4.5 Parallelism and Squareness of Liner Flanges

**4.5.1** Flange faces of liners shall be parallel within 0.012 mm.

**4.5.2** Lower flange faces shall be square to outside location diameters within the following limits:

<i>Nominal Cylinder Bore</i>	<i>Squareness Limits (Total Indicator Reading)</i>
mm	mm
Up to and including 150	0.05
Above 150	0.063

**5. Surface Finish** — The surface finish on the finish machined liner shall be in accordance with Table 3.

**TABLE 3 SURFACE ROUGHNESS OF CYLINDER LINERS**

Surface	Wet Liner, Ra	Dry Liner, Ra
Outer seating surface (turned)	Max 5.7 $\mu$ m	Max 4.6 $\mu$ m
Outer seating surface (ground)	Max 1.6 $\mu$ m	Max 1.6 $\mu$ m
Bore	0.5 to 1.6 $\mu$ m	0.5 to 1.6 $\mu$ m

Roughness values lesser than the limits specified in Table 3 shall be mutually agreed to between the purchaser and the manufacturer. The bore surface of the liners shall be finished by honing with a cross-hatch pattern having an included angle between 30° and 60° in the horizontal plane.

#### 6. Inspection

**6.1 Range of Inspection** — Shall be as agreed to between the purchaser and the manufacturer.

**6.2 Dimensional Inspection** — All dimensions shall be checked against values given on the finished part drawings in conjunction with permissible tolerances according to Table 2.

**6.2.1 Grading for selective assembly** — When assembly requirement calls for closer fit tolerance than obtainable with the standard, grading of outer diameter and/or inner diameter of the liner may be resorted to as agreed to between the manufacturer and the purchaser.

**6.3 Roughness Inspection** — It shall be carried out in accordance with IS : 3073-1967 'Assessment of surface roughness' on the bore surface in the region over which the piston rings operate.

**6.3.1** The roughness on the outer seating surface may be estimated visually or by comparative checking.

#### 6.4 Micro-structure Examination

**6.4.1** The sample for micro-structure examination shall be taken from the bore running surface at a place in the region over which the piston rings would operate.

**6.4.2** The following scales of magnification shall be used for determining the micro-structure:

Graphite	100 x
Matrix	500 x
Phosphide eutectic	10 x or 100 x

For estimating the permissible ferrite content, the average over a surface area of approximately 1 mm<sup>2</sup> shall be taken.

**6.5 Hardness** — The Brinell hardness shall be measured on the machined upper end face of the liner as specified in IS : 1500-1983 'Method for Brinell hardness test for metallic materials (*second revision*)'. An average value of three readings uniformly distributed over the circumference on the upper end face of the liner shall be taken as the actual hardness value.

**Note** — The distance of the centre of the impression shall be at least twice the ball diameter from the edge of the liner.

## **7. Acceptance**

**7.1** All characteristics in accordance with this standard shall be checked at the final inspection by the manufacturer.

**7.2** Minor casting defects will be acceptable provided these do not have any influence on the life or performance of the liners. A guideline regarding such permissible casting defects is given in Appendix A.

## **8. Marking**

**8.1** Minimum markings on the outer surface of the cylinder liner shall be as follows:

- a) Name, trade name or registered trade-mark of the manufacturer;
- b) Application; and
- c) Size.

Any additional markings shall be decided between the purchaser and the manufacturer.

**8.2 ISI Certification Marking** — Details available with the Indian Standards Institution.

**8.3** The marking shall preferably be done with a suitable etching media which shall not get easily eroded.

## **9. Packing**

**9.1** Liners shall be adequately protected with anti-corrosive protective media and suitably wrapped.

**9.2** Each liner shall be placed in a well-fitting carton and further suitably created to avoid damage during transport.

**9.3** In case of overseas transport, additional specifications available for such transport shall be followed.

**10. Surface Coatings** — Surface of wet liners in contact with water may be coated with suitable anti-cavitation surface coatings as agreed to between the purchaser and the manufacturer.

**APPENDIX A**

(Clause 7.2)

**ACCEPTANCE STANDARD FOR CASTING DEFECTS AND DAMAGES ON CYLINDER LINERS****A-1. Casting Defects**

**A-1.1** Acceptability of casting defects is to be decided in accordance with location, size and nature of defect.

**A-1.2** For determining the location, the machined cylinder liner bore shall be divided into 3 zones which are to be indicated on the drawing by the purchaser as follows:

Zone A = Above the piston ring path

Zone B = Piston ring path

Zone C = Below the piston ring path

**A-1.3 Defects in Cylinder Liner Bore** — Uniformly distributed defects, such as blow holes and microporosity are permissible in the finish machined cylinder liner bore in accordance with the following table:

Zone	Maximum Dia of Defects mm	Number of Defects for Bore Dia			
		Up to 50 mm	Above 50 Up to 150 mm	Above 150 mm	
A	1	2	3	5	
B	Nil	Nil	Nil	Nil	
C	2	3	5	5	

**A-1.3.1** For a distance of 5 mm from either end of the cylinder, no casting defects are permissible.

**A-1.3.2** The depth of the defect shall be not more than 20 percent of the wall thickness subject to a maximum of 1 mm.

**A-1.3.3** The distance of the defect-spots from one another shall be not less than 50 mm.

**A-1.4 Defects on the Outer Surface of Cylinder Liner**

**A-1.4.1** No defects are permissible on sealing faces of the outer surfaces.

**A-1.4.2** On the faces of the outer surface where no sealing takes place, uniformly distributed defects according to the following table are permissible.

Zone	Maximum Dia of Defects for		Number of Defects for	
	Wet Liner mm	Dry Liner mm	Wet Liner	Dry Liner
A	1	3	4	5
B	3	3	5	5
C	3	3	3	5

**A-1.4.3** With regard to distance of defects from one another and from the ends of the cylinder liners, those outlined in A-1.3 are valid. Defects in the bore and on the outer surface shall not lie on one another.

**A-2. Mechanical Surface Damages—**Mechanical damages in the process of machining are permissible so long as they do not affect the performance of the cylinder liners.

**A-2.1 Defects under this category are:**

- a) Grooves on water jacket which are caused by the return motion of the tools;
- b) Grooves on the seating surfaces, provided no material has been removed and provided the seating surfaces are not simultaneously used for sealing; and
- c) Small out-breaks in the region of the slotted portion for the connected rod.

**A-2.2 Damages on the cylinder bore, as also on the sealing surfaces of the liner, are not permissible.**

## **EXPLANATORY NOTE**

This standard was first published in the year 1972. The revision is being issued in the light of experience gained in the implementation of the standard by the manufacturers and the users.

In this revision following changes have been made:

- a) Wet liners with the outside surface as cast are also being covered;
- b) Liners have been classified into two groups according to hardness, namely, 'soft' and 'hard' to cover the requirements of high powered engines;
- c) Measurement of hardness has been made more specific;
- d) Tolerances for chamfers according to IS : 2102-1969 have been included;
- e) Surface roughness for ground outer seating surface have been included; and
- f) Grading of liners for selective assembly have been included.